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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/500,079

03/01/2005

Jochen Kraft

14603-007US1

5865

26161 7590 03/14/2007  
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EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

03/14/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	Application No. 10/500,079	Applicant(s) KRAFT ET AL.	
	Examiner Anh D. Mai	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 23 June 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☒ Certified copies of the priority documents have been received in Application No. PCT/EP02/14679.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>6/23/2004 - 2/09/2005</u>                                     | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Status of the Claims*

1. Amendment filed June 23, 2004 is acknowledged. Claims 1-6 have been amended. Claims 7-20 have been added. Claims 1-20 are pending.

### *Specification*

The following title is suggested:

HETEROJUNCTION BIPOLAR TRANSISTOR (HBT) HAVING BASE LAYER  
BEING COUNTER-DOPED FROM THE EMITTER.

### *Claim Rejections - 35 USC § 101*

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to neither a “process”, mode of operating a device, e.g., counter-doped with a pentavalent substance in a region adjacent to the emitter, nor a “machine”, e.g., HBT, but rather embraces or overlaps two different statutory classes of invention set forth in 35 U.S.C. 101 which is draft so as to set forth the statutory classes of invention in the alternative only. *Id.* At 1551.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, last four lines, recites: a first doping layer that is doped with a trivalent substance, that extends into the extrinsic region, and that is counter-doped with a pentavalent substance in a region adjacent to the emitter.

However, it is well known that the “counter-dope”, also known as “depletion region” is only occurred when the HBT is in operation. As a device, the dopants of the emitter stay in the emitter.

A single claim which claims both an apparatus, the instant HBT, and the method steps of using the apparatus, the instant counter-doped from the emitter, is indefinite under 35 U.S.C. 112, second paragraph. In *Ex parte Lyell*, 17 USPQ2d 1548 (BPAI 1990).

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-17, 19 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Asai et al., (WO 01/91162) of record.

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With respect to claim 1, as best understood by the examiner, Asai teaches a transistor as claimed including:

- an emitter (129);

- a collector (102); and

- a base layer (111) having a base contact (115), the base layer (111) comprising:

  - an intrinsic region (119) between the emitter (129) and the collector (102);

  - an extrinsic region (116) between the intrinsic region (119) and a the base contact (115); and

  - a first doping layer (153-top) that is doped with a trivalent (boron) doping substance, that extends into the extrinsic region (116) and that is counter-doped with a pentavalent (phosphorous) substance in the a region of adjacent to the emitter (129). (See Figs. 1-2).

With respect to claims 2 and 10, the trivalent doping substance of Asai is comprises boron.

With respect to claim 3, the base layer (111) of Asai further comprises:

- a second doping laver (153-middle + upper portion 152) that is doped with a trivalent (boron) doping substance, and that is between the first doping layer (153-top) and the collector (102); and

- a third doping layer (remaining of 152) that is doped with a trivalent (boron) substance, and that is between the second doping layer (153-middle + upper portion 152) and the collector (102);

wherein the concentration of trivalent substance in the second doping layer (153-middle + upper portion ) is less than the concentration of trivalent substance in the first doping layer (153-top) and the concentration of trivalent substance in the second doping layer (153-middle + upper portion 152) is less than the concentration of trivalent substance in the third doping layer (remaining of 152). (See Fig. 2).

With respect to claims 4 and 7, the first doping layer (153-top) of Asai comprises at least 30% of the total amount of a doping substance of in the base layer (111).

With respect to claims 5 and 8, the base layer (111) of Asai further comprises: a substance diffused into the base layer (111) from a region that corresponds to the collector (129).

With respect to claims 6 and 9 , the base layer (111) comprises carbon atoms having a concentration greater than  $E18\text{ cm}^{-3}$ . (See Fig. 13).

With respect to claim 11, the second doping layer (153-middle + upper portion 152) and the third doping layer (remaining of 152) are doped with germanium.

With respect to claim 12, the concentration of germanium in the second doping layer (153-middle + upper portion 152) and the third doping layer (remaining of 152) decreases from a high point (15%) at the collector (102) to a low point (0%) in the second layer (upper 152); and a decrease in the concentration of germanium from the high point (15%) to the low point is substantially constant (gradual).

With respect to claim 17, the trivalent substance comprises boron.

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With respect to claim 13, as best understood by the examiner, Asai teaches a transistor as claimed including:

a base layer (111) comprising:

a first doping layer (153-top) that is doped with a trivalent substance;

a second doping layer (153-middle + upper 152) adjacent to the first doping layer (153-top) and having a lower concentration of the trivalent substance than the first doping layer (153-top); and

a third doping layer (remaining of 152) adjacent to the second doping layer (153-middle + upper 152) and having a higher concentration of the trivalent substance than the second doping layer (153-middle + upper 152);

wherein the first doping layer (153-top) and the second doping layer (153-middle + upper 152) are counter-doped with a pentavalent substance in an emitter region (129) of the transistor. (See Fig. 2).

With respect to claim 14, the second doping layer (153-middle + upper 152) and the third doping layer (remaining 152) are doped with germanium.

With respect to claim 15, the concentration of germanium in the second doping layer (153-middle + upper 152) and the third doping layer (remaining 152) decreases from a high point (15%) at a collector region (102) of the transistor to a low point (0%) in the second layer (153-middle + upper 152).

With respect to claim 16, a decrease in the concentration of germanium from the high point (15%) to the low point (0%) is substantially constant.

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With respect to claim 19, as best understood by the examiner, Asai teaches a transistor as claimed including:

- a collector region (102);

- an emitter region (129); and

- a base layer (111) between the collector region (102) and the emitter region (129), the base layer comprises:

  - an intrinsic region (119) between the collector (102) and the emitter (129); and

  - an extrinsic region (116) outside the intrinsic region (119);

  - wherein the intrinsic region (119) and the extrinsic region (116) comprise plural layers that are doped with different concentrations of a trivalent substance; and

  - wherein at least some of the plural layers in the intrinsic region (119) are doped, from the emitter region (129), with a pentavalent substance. (See Figs. 1-2).

With respect to claim 20, at least some of the plural layers in the intrinsic region (119) are doped, from the collector region (102), with germanium; a concentration of the germanium decreases from a high point (15%) at the collector region (102) to a low point (0%) in one of the plural layers doped with the trivalent substance; and a decrease in the concentration of germanium from the high point to the low point is substantially linear.

5. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Asai '162 as applied to claim 11 above, and further in view of Morishita (U.S. Patent No. 5,140,400).



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Asai teaches a transistor as described in claim 11 above including: the first doping layer (153-top) that is doped with a trivalent substance that extends into the extrinsic region and is counter-doped with a pentavalent (N-type) substance in the region adjacent to the emitter, wherein the emitter is formed with N-type having a concentration of  $E20\text{ cm}^{-3}$ .

Thus, Asai is shown to teach all the features of the claim with the exception of explicitly disclosing the atom being used for the pentavalent (N-type) substance.

However, Morishita teaches that it is well known in the art to use phosphorous, arsenic, antimony, or the like of group V atoms for N-type substance in a transistor. (Col. 10, ll. 38-46).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to counter-doped the first doping layer of Asai utilizing arsenic as atoms of pentavalent substance since it is well known in the art to use any material of group V element for N-type emitter.


### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



**ANH D. MAI**  
**PRIMARY EXAMINER**